REMARKS

Receipt of the Office Action mailed May 4, 2001 is acknowledged. Claims 1, 9 and 10 have been amended. Claim 20 has been added. Support for claim 20 can be found in original claim 1. Claims 1-4, and 5-20 are pending. Entry of the forgoing amendments and favorable reconsideration are earnestly solicited.

Claims 1-3 and 5-19 stand rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. Claims 1-3, 5-7, 11-14 and 15-19 stand rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Scholze et al. (U.S. Patent No. 4,238,590) (hereinafter "Scholze '590"). Claims 1-2, 6, 15 and 16 stand rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Scholze et al. (U.S. Patent No. 4,374,933) (hereinafter "Scholze '933"). These rejections are respectfully traversed.

1. Claims 1-3 and 5-19 are definite

Claims 1-3 and 5-19 stand rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. Claim 1 has been amended to clarify this claim by deleting the term preferably. The cancelled subject matter has been presented in dependent claim 20. Reconsideration and withdrawal of these rejections is earnestly solicited.

2. Claims 1-3 and 5-20 are Patentable over the Prior Art of Record

Claims 1-3, 5-7, 11-14 and 15-19 stand rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Scholze '590. Claims 11-2, 6, 15 and 16 stand rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Scholze '933. These rejections are traversed.

The present invention, as set forth in claim 1, relates to the preparation of a semipermeable membrane by hydrolytic polycondensation of a material comprising at least one of the silanes having formulae I, II, III and IV (or precondensates thereof), optionally in the presence of a silane having formula V. In all of these silanes, a radical X is attached. The radical X may be hydrogen, halogen, hydroxyl, alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl or $NR"_2$, where R" is hydrogen, alkyl or aryl. As set forth in the formulae, the radical X is always directly attached to the silicon atom. The hydrolytic polycondensation of these compounds is carried out by adding water, a solvent and/or a condensation catalyst. The liquid or resin obtained therewith "represents a polycondensate

of hydrolytically condensed silicon compounds of the formula I and/or II and/or III and/or IV and, if used V," (*See* page 11, lines 19 to 21 of the instant specification). It would have been clear to the person having ordinary skill in the art from the instant specification that hydrolysis of any of compounds I to V will result in the removal of group X, and that the subsequent condensation will result in the formation of a Si-O-Si-O... backbone or framework. Thus, even if the term "polycondensation" can also be used in order to designate organic condensation reactions like, e.g., those which yield polyesters, polyimides and the like, it is clear that when compounds of formulae I to IV undergo hydrolytic polycondensation, the result must be the formation of the inorganic Si-O-Si backbone or framework.

Furthermore, step (d) of claim 1 recites that the membrane is cured by forming an organic network using a process which may include thermal curing, radiation-induced curing and/or chemically induced curing. Scholze '590 and Scholze '933 do not disclose or suggest the use of functional silane compounds which are able to undergo organic polymerization as set forth in the instant claims. In the Office Action, the Examiner took the position that polymerization and polycondensation are equivalent and that, therefore, the instant claims would have been obvious over Scholze '590 or Scholze '933. It is respectfully submitted that the Examiner is in error. Although the Examiner's statement is correct in principle, the Examiner disregarded step (d) of the instant claim and instead relied only on the term "polycondensation."

As outlined above, claim 1 makes clear that the "polymerization" means in this connection "formation of an organic network using a process selected from the group consisting of thermal curing, radiation-induced curing and chemically induced curing". Thus, the term "polymerization" relates to the formation of an organic network (or framework) within the polymeric material which had already been obtained by hydrolytic condensation of the inorganic parts (i.e. Si-O-Si...).

Thus, step (d) of claim 1 describes something which is not "equivalent", but "different" from the hydrolytic condensation of step (a), namely polymerization of organic parts of the material obtained by hydrolytic condensation. All four compounds of formula I to IV contain groups which can participate within such a reaction and are sensitive to thermal, radiation-induced and/or chemically-induced organic polymerization: compounds of formula I contain a norbornene group having a C=C group and being under ring

tension, while the compounds of formulae II and III contain a group B which is a straight-chain or branched organic radical having at least one C=C double bond, and the compounds of formula IV contain a group which is an organic radical having 1 to 5 mercapto groups.

While it is clear that the hydrolytically condensed material derived from compounds of formula I to III can be cured by thermal curing, radiation-induced curing and/or chemically-induced curing without a reaction partner, it is necessary to provide the presence of additives which are addition-copolymerizable and/or can be subjected to an addition and/or polyaddition reaction if the hydrolytically condensed material to be cured according to step (d) is merely derived from compounds of formula IV since mercapto groups need such additives in order to provide a curing of the organic network (so called thiol-ene-reaction).

From the foregoing, it is evident that: (1) step (a) as defined in claim 1 is directed to hydrolytic silane condensation which necessarily results in Si-O-Si formation, i.e., an inorganic condensation, (2) that step (d) as defined in claim 1 is directed to a curing reaction, forming an organic network, and (3) that steps (a) and (d) have to be performed in addition. These steps are not disclosed or suggested by the prior art of record.

Scholze '590 describes formation of silicic acid heteropolycondensates obtained by hydrolytic condensation of compounds having formulae I, II and III. The Examiner is of the opinion that these formulae are comparable to formulae Ill, IV and V of the present invention. Formula III of the present invention, however, contains a group B having at least one, and in specific cases at least two, C=C double bonds which is able to undergo organic curing reactions thereby forming an organic network. Scholze '590 does not disclose or suggest the group B in any of their formulae I to III. Furthermore, Scholze does not disclose or suggest organic curing. The Examiner's assertion that this is disclosed in the reference is incorrect. Scholze '590 does not teach or suggest forming an organic network by subjecting the claimed compounds to an organic curing. Scholze '590 is completely silent regarding curing step which would provide an organic network within the hydrolytically condensed material.

According to the Examiner, formula IV of the present invention is comparable to formula III of the Scholze patent, both compounds having at least one mercapto group. However, claim 1 of the present invention recites that additives must be present where they

are required to obtain an organic network by a curing reaction. Since mercapto groups cannot undergo organic curing when used alone, additives are necessary if a compound of formula IV is used as the only compound of the material of claim 1. Such an additive, however, is not disclosed nor suggested in the Scholze '590 patent. Thus, Scholze '590 does not disclose or suggest the instantly claimed method.

Scholze '933 also does not disclose or suggest the instantly claimed method. Scholze '933 relates to the formation of silicic acid heteropolycondensates. The starting substances having formulae I to III are similar to those of the '590 patent, at least as far as their relevance to their silanes of I to IV of the present invention is concerned. However, this document, like Scholze '590, neither discloses nor suggests the step of curing the membrane by forming an organic network by thermal curing, radiation-induced curing and/or chemical-induced curing as set forth in the instant claims.

In addition, U.S. Patent No. 4,505,985 is directed to membranes based on silicic acid heteropolycondensates. The '985 patent includes two of the three inventors of the Scholze '933 patent and both of the inventors of the Schloze '590 patent. In the discussion of the prior art, the earlier Scholze '590 and Scholze '933 patents are discussed in the '985 patent. According to the '985 patent, the membranes disclosed in the '590 patent are often insufficiently elastic. Furthermore, the '985 patent recites that the slices of membrane according to the '590 patent break when cut and that the membrane surface required is not achieved in most cases by the method of the '590 patent. Further, according to the '985 patent, the porous membranes obtained by the '933 patent contain a great deal of water by virtue of contact with an aqueous phase and therefore when they are dried, excessive shrinking and associated crack formation may occur. Thus, it was clear already in 1982 that the methods to obtain porous membranes according to the processes of the Scholze patents '590 and '933 did not yield acceptable results. Therefore, there was a need to overcome the disadvantages of this state of the art. The method of the present invention which includes the additional curing step (d), however, is superior over the methods disclosed by Scholze '590 and Scholze '933 because the membranes obtained are of high elasticity (for example, they can be extruded through an annular dye and the resulting continuous fiber is wound up and re-wound, see page 25, first paragraph.) Alternatively, the product according to the present invention may be in the form of a film, see page 26, first three lines.

Since neither Scholze '590 nor Scholze '933 disclose or suggest the method set forth in claim 1, this claim is patentable over Scholze '590 and Scholze '933. Since claims 2-3 and 5-20 depend from claim 1, for at least these reasons these claims are also patentable over Scholze '590 and Scholze '933.

3. Conclusion

In view of the foregoing, it is respectfully urged that the present claims are in condition for allowance. An early notice to this effect is earnestly solicited. Should there be any questions, Examiner Fortuna is courteously invited to contact the undersigned at the telephone number shown below.

Respectfully submitted,

Date September 4, 2001

By _____

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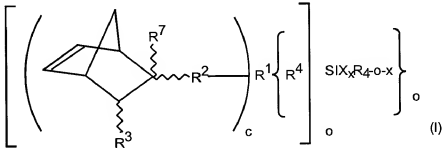
VERSION WITH MARKINGS TO SHOW CHANGES MADE

Marked up rewritten claims:

1. (2x amended) A process for producing a semipermeable membrane, comprising

(a) preparing a low-viscosity to resinous liquid produced by hydrolytic polycondensation of a material comprising at least one compound selected from the group consisting of:

(i) a compound of formula I



(I)

wherein

R = alkyl, alkenyl, aryl, alkylaryl or arylalkyl comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

R^1 = alkylene, arylene, arylenealkylene or alkylenearylene comprising between 0 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

R^2 = alkylene, arylene, arylenealkylene or alkylenearylene comprising between 0 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

R^3 = hydrogen, R^2-R^1-R^4-SiX_xR_{3-x}, carboxyl, alkyl, alkenyl, aryl, alkylaryl or arylalkyl comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

R^4 = $(CHR^6\text{-}CHR^6)_n$- , where n = 0 or 1, -CHR^6-CHR^6-S-R^5-, -CO-S-R^5-, CHR^5-CHR^6-NR^6-R^5-, -Y-CS-NH-R^5, -S-R^5, -Y-CO-NH-R^5, -CO-O-R^5-, -Y-CO-C_2H_3(COOH)-R^5-, -Y-CO-C_2H_3(OH)-R^5- or –CO-NR^6-R^5-,

R^5 = alkylene, arylene, arylenealkylene or alkylenearylene comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

R^6 = hydrogen, alkyl or aryl having 1 to 10 carbon atoms,

R^7 = hydrogen, alkyl, alkenyl, aryl, alkylaryl or arylalkyl comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

X = hydrogen, halogen, hydroxyl, alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl or NR''_2, where R'' = hydrogen, alkyl or aryl,

Y = -O-, -S- or -NR^6-,

Z = -O- or -$(CHR^6)_m$-, where m = 1 or 2,

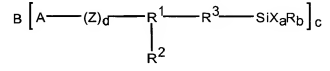
a = 1, 2 or 3, where b = 1 if a = 2 or 3,

b = 1, 2 or 3, where a = 1 if b = 2 or 3

c = 1 to 6,

x = 1, 2 or 3, where a+x = 2, 3 or 4;

(ii) a compound of formula II



(II)

wherein

B = a straight-chain or branched organic radical having at least one C = C double bond and 4 to 50 carbon atoms,

R = alkyl, alkenyl, aryl, alkylaryl or arylalkyl comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

R^3 = alkylene, arylene, arylenealkylene or alkylenearylene comprising between 0 to 10 carbon atoms, wherein any of these radicals optionally is interrupted by an atom or group selected from the group consisting of oxygen atom, sulfur atom, and amino group,

X = hydrogen, halogen, hydroxyl, alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl or NR''_2, where R'' = hydrogen, alkyl, aryl or alkylaryl,

A = O, S or NH if d = 1 and Z = CO and

R^1 = alkylene, arylene or alkylenearylene comprising between 1 to 10 carbon atoms, wherein any of these radicals optionally is interrupted by an atom or group selected from the group consisting of oxygen atom, sulfur atom, and amino group, and

R^2 = COOH or H,

or

A = O, S, NH or COO if d = 1 and Z = CHR', where

R' = H, alkyl, aryl or alkylaryl, and

R^1 = alkylene, arylene or alkylenearylene comprising between 1 to 10 carbon atoms, wherein any of these radicals optionally is interrupted by an atom or group selected from the group consisting of oxygen atom, sulfur atom, and amino group, and

R^2 = OH

or

A = O, S, NH or COO if d = 0 and

R^1 = alkylene, arylene or alkylenearylene comprising between 1 to 10 carbon atoms, wherein any of these radicals optionally is

interrupted by an atom or group selected from the group consisting of oxygen atom, sulfur atom, and amino group, and

R^2 = OH,

or

A = S if d = 1 and Z = CO and

R^1 = N and

R^2 = H,

a = 1, 2 or 3,

b = 0, 1 or 2, where a+b = 3,

c = 1, 2, 3 or 4;

(iii) a compound of formula III

$$\{X_aR_bSi[(R'A)_c]_{(4-a-b)}\}_xB \qquad (III)$$

wherein

A = O, S, PR'', POR'', NHC(O)O or NHC(O)NR'',

B = a straight-chain or branched organic radical derived from a compound B' having at least one (if c = 1 and A = NHC(O)O or NHC(O)NR^{11}) or at least two C = C double bond(s) and 5 to 30 carbon atoms,

R = alkyl, alkenyl, aryl, alkylaryl or arylalkyl comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

R' = alkylene, arylene or alkylenearylene,

R'' = hydrogen, alkyl, aryl or alkylaryl,

X = hydrogen, halogen, hydroxyl, alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl or NR''_2,

a = 1, 2 or 3,

b = 0, 1 or 2,

c = 0 or 1,

x = an integer whose maximum value corresponds to the number of double bonds in the compound B' minus 1, or is equal to the number of double bonds in the compound B' if c = 1 and A is NHC(O)O or NHC(O)NR'',

wherein said alkyl and alkenyl radicals optionally are substituted straight-chain, branched or cyclic and comprise 1 to 20 carbon atoms, the aryl optionally is a substituted phenyl, naphthyl or biphenylyl, the alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl, alkylaryl, arylalkyl, arylene, alkylene and alkylenearyl radical is a derivative of said alkyl or aryl radical;

(iv) a compound of formula IV

$$Y_aSiX_xR_{4-[2]\underline{a}\,x} \qquad (IV)$$

wherein

R = alkyl, alkenyl, aryl, alkylaryl or arylalkyl comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

X = hydrogen, halogen, hydroxyl, alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl or NR''_2, where R'' = hydrogen, alkyl, aryl or alkylaryl,

Y = an organic radical having 1 to 30**[, preferably 1 to 20]** carbon atoms and 1 to 5**[, preferably 1 to 4]** mercapto groups,

a = 1, 2 or 3,

x = 1, 2 or 3, where a+x = 2, 3 or 4;

and

(v) a precondensate derived from a compound **[shown]** represented **[in] <u>by</u>** any of formulae I to IV

and wherein said hydrolytic polycondensation material further optionally comprises at least one compound selected from the group consisting of:

(1) a compound of formula V

$$X_aSiR_{4-a} \qquad (V)$$

wherein

R = alkyl, alkenyl, aryl, alkylaryl or arylalkyl comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected

from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino,

X = hydrogen, halogen, hydroxyl, alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl or NR''_2, where R'' = hydrogen, alkyl, aryl or alkylaryl,

a = 1, 2 or 3; and

(2) a precondensate derived from a compound of formula V;

wherein said hydrolytic polycondensation is conducted by adding a substance selected from the group consisting of water, a solvent, and a condensation catalyst, and wherein said molar ratio of the sum of the compound(s) of formulaes I, II, III and IV to the sum of compound(s) of formula V is between 1:0 and 1:20,

(b) forming a membrane from the said low-viscosity to resinous liquid,

(c) optionally drying the membrane, and

(d) curing the membrane by forming an organic network using a process selected from the group consisting of thermal curing, radiation-induced curing and chemically induced curing, optionally or if necessary, in the presence of additives which are addition-copolymerizable and/or can be subjected so an addition and/or polyaddition reaction.

9. (2x amended) The process as claimed in claim 1, wherein said liquid **[further]** comprises at least one polycondensate derived from at least one compound of formula VI, having the structure:

$$[(HSR^5)_nR^6\text{-}S\text{-}E\text{-}R^5]_aSiX_1R_{4-a-x} \qquad (VI)$$

wherein

E = -CO-NH-, -CS-NH-, $-CH_2-CH_2-$ or $-CH_2-CH(OH)-$;

R = alkyl, alkenyl, aryl, alkylaryl or arylalkyl comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino;

R^5 = alkylene, arylene, arylenealkylene or alkylenearylene comprising between 1 to 15 carbon atoms, wherein optionally one or more radicals is interrupted by an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino;

R^6 = alkylene, arylene, arylenealkylene or alkylenearylene comprising between 1 to 15 carbon atoms, wherein optionally one or more radicals is interrupted by an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino;

X = hydrogen, halogen, hydroxyl, alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl or NR''_2, where R'' = hydrogen, alkyl, aryl or alkylaryl;

a = 1, 2 or 3;

n = 2, 3, 4 or 5;

x = 1, 2 or 3, where a+x = 2, 3 or 4.

10. (2x amended) The process as claimed in claim 1, wherein said liquid comprises polycondensates comprising at least one compound selected from the group consisting of a compound according to formula II or III wherein radical B has at least one acrylate or methacrylate group, and **[further]** comprises a compound according to the formula VI

$$[(HSR^5)_nR^6\text{-}S\text{-}E\text{-}R^5]_a\ SiX_xR_{4-a-x} \qquad (VI)$$

wherein

E = -CO-NH-, -CS-NH-, $-CH_2-CH_2-$ or $-\ CH_2-CH(OH)-$;

R = alkyl, alkenyl, aryl, alkylaryl or arylalkyl comprising between 1 to 15 carbon atoms, further optionally comprising an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino;

R^5 = alkylene, arylene, arylenealkylene or alkylenearylene comprising between 1 to 15 carbon atoms, wherein optionally one or more radicals is interrupted by an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino;

R^6 = alkylene, arylene, arylenealkylene or alkylenearylene comprising between 1 to 15 carbon atoms, wherein optionally one or more radicals is interrupted by an atom or group selected from the group consisting of oxygen atom, sulfur atom, ester, carbonyl, carboxyl, amido, and amino;

X = hydrogen, halogen, hydroxyl, alkoxy, acyloxy, alkylcarbonyl, alkoxycarbonyl or NR''_2, where R'' = hydrogen, alkyl, aryl or alkylaryl;

a = 1, 2 or 3;

n = 2, 3, 4 or 5;

x = 1, 2 or 3, where a+x = 2, 3 or 4.